BUREAU OF ENVIRONMENTAL REMEDIATION POLICY

CLEAN-UP LEVELS FOR TOTAL PETROLEUM HYDROCARBONS

BER POLICY # BER-RS-041
DATE: December 28, 2000
PAGES: 4

Section Chief: _____ **Date:** 12/29/05

Bureau Manager: _____ **Date:** 12/30/05

REVISIONS

Reviser: **Date of Revision:**

ORIGINATOR

Originator: **Rob Elder** **Date:** **12/28/2000**

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This policy establishes Total Petroleum Hydrocarbon (TPH) human health and environmental risk-based actions levels consistent with the procedures adopted within the Risk-Based Standards for Kansas (RSK) manual. The policy will serve as an addendum to Appendix A of the RSK manual.

Total Petroleum Hydrocarbons (TPH), for the purpose of this technical memorandum, includes all undifferentiated hydrocarbons including carbon range compounds C^5 through C^{35} containing various percentages of straight chain alkanes, branched chain alkanes, cycloalkanes, straight alkenes, branched chain alkenes, cycloalkenes, alkyl benzenes, naphtheno benzenes, alkyl naphthalenes and polynuclear aromatics. TPH concentrations in soil and ground water, as it relates to Tier 2 of the RSK manual, shall be quantified by summing TPH using the EPA SW-846 modified method 8015, also known as laboratory analytical methods OA1 for gasoline range organics (GRO) and OA2 for diesel range organics (DRO). The term undifferentiated TPH implies that specific hydrocarbon chemicals for which chemical-specific toxicity values are available, such as benzene for GRO or benzo[a]pyrene for DRO, are not detected above the practical quantitation limit for the referenced lab methods.

Considering that TPH detected at a site is commonly found as either GRO or DRO, KDHE has developed two separate Tier 2 risk-based concentrations based upon whether the TPH is entirely GRO or DRO. For pure GRO-type TPH, the Tier 2 RSK values are based upon the physical, chemical, and toxicologic properties of n-hexane. For pure DRO-type TPH, the Tier 2 RSK values are based upon the physical, chemical, and toxicologic properties of pyrene. As provided within Appendix A of the RSK manual, the Tier 2 values for undifferentiated TPH as GRO and DRO are provided in Table 1.

Table 1

	Residential			Non-Residential		
	Soil	Soil to GW	Groundwater	Soil	Soil to GW	Groundwater
TPH Type	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)
GRO	220	39	0.500	450	150	0.500
DRO	2,000	3,000	0.500	20,000	15,000	0.720

If the site has only one type of TPH detected, the values in Table 1 for the detected type of TPH can be used directly. For sites where both types of TPH are detected, calculate the sum of the ratios of the detected concentrations of each hydrocarbon type to their corresponding Tier 2 values as follows:

$$\frac{X}{\text{GRO Tier 2 Value}} + \frac{Y}{\text{DRO Tier 2 Value}} = N$$

X = Detected GRO Concentration
Y = Detected DRO Concentration
N = Sum

For instance, with detected GRO and DRO concentrations in soil of 22 and 1000 mg/kg respectively, N = (22/220) + (1,000/2,000) = 0.6. The site may be closed if N is less than or equal to 1. If N is greater than 1 remediation should be performed.

As outlined in Table 1, the most conservative clean-up value for non-discrete TPH in soil is the soil to groundwater pathway value. The equation for the soil to groundwater pathway calculation is provided as Equation 5 (for organics) in the RSK manual. The chemical specific information and equation parameters required to perform this calculation are provided in Table 5 and Appendix B of the RSK manual. For the purposes of this technical memorandum, the physical and chemical properties for both GRO and DRO are provided in Table 2 of this document.

Implementation Policy

Consistent with KDHE's RSK Manual, dated March 24, 1999, the application of this technical memorandum must be coordinated with and approved by KDHE's Bureau of Environmental Remediation in writing to be formally accepted by the Bureau. In addition, this policy is only applicable where appropriate laboratory analyses have determined that refined petroleum constituents for which specific toxicological data are available are not detected above their respective laboratory practical quantitation limits. These constituents include but are not limited to benzene, toluene, ethylbenzene, total xylenes (BTEX), methyl-tert-butyl-ether (MTBE), ethylene dibromide (EDB), and 1,2-dichloroethane (1,2-DCA) for TPH-GRO and chrysene, pyrene, benzo[a]pyrene, and anthracene for TPH-DRO. Lastly, **free product must be removed** as a requirement for using the risk-based Tier 2 clean-up levels established within this policy.

Table 2

TPH physical/chemical parameters	Value
MW - molecular weight	150 g/mol
HLC - Henry's Law Constant	0.05 atm-m^3/mol
H' - Henry's Law Constant (dimensionless)	2.08
Log K_{OC}	5.23 l/kg
K_{OC}	168,000 l/kg
Kd - Soil-water partition coefficient	1,680 l/kg
Kp	0.363
Log K_{OC}	4.5

References

Kansas Department of Health and Environment, "Risk-Based Standards for Kansas Manual", March 24, 1999.

Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 1 "Analyses of Petroleum Hydrocarbons in Environmental Media", March 1998.

Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 2 "Composition of Petroleum Mixtures", March 1998.

Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 3 "Selection of Representative TPH Fractions Based on Fate and Transport Considerations", March 1998.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, "Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter", August 1994.

Texas Natural Resource Conservation Commission, "Updated Baseline TPH Cleanup using the Massachusetts Surrogate Approach & the TNRCC's Memo Entitled, "Implementation of the Existing Risk Reduction Rule" dated July 23, 1998", March 2, 1999.

Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 4 "Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons", March 1998.

ADDENDUM TO TPH POLICY

This is an addendum to BER Policy #BER-RS-041, "**CLEAN-UP LEVELS FOR TOTAL PETROLEUM HYDROCARBONS.**"

The addendum clarifies the use of "Non-Residential" human health and environmental risk-based action levels outlined in **Table 1** of the policy. As defined in K.A.R. 28-71-11, "The selection of cleanup levels shall be based on the present and proposed future uses of the property and surrounding properties." The current and future use of the property and the ownership of the property must be considered when determining the use of "Non-Residential" action levels. Non-Residential TPH standards should not be used in the following situations unless approved by the KDHE project manager:

1) sites where contamination is caused by a responsible party that does not own or control the property;
2) sites where a deed restriction can not be used to control future use of the property (i.e. assuring that the non-residential setting will not be a residential setting in the future); and
3) sites where contamination is located on the responsible parties' property but migrating or threatening to migrate to an adjacent property not under the ownership or control of the responsible party.

In most of these cases, the residential standards should be used as the target clean-up levels.

In general, the non-residential standards for TPH as provided in Table 1 of BER-RS-041 should be used only in situations where the responsible party owning or controlling the property can assure non-residential uses of the property in perpetuity. **KDHE has the final discretion in determining cleanup levels for a property based on current and future land use issues.**